Rapid Mission Planning for Desirable Viewing Conditions

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Description:
OBJECTIVE: To develop a method to optimize scheduling and planning for Space Situational Awareness (SSA) collects. DESCRIPTION: The AFSPC (Air Force Space Command) Space Surveillance Network (SSN) and AFRL (Air Force Research Laboratory) utilizes a number of ground based observatory telescope systems to observe satellites and obtain awareness to support Space Situational Awareness (SSA). These telescope systems can operate in a variety of configurations to collect highly resolved images of Low Earth Orbiting (LEO) satellites and to perform non-resolved detection/astronomy/photometry of both Geosynchronous Earth Orbit (GEO) and LEO satellites. In astronomy, mission planning and scheduling of telescopes is simply a matter of determining whether the object is within the field of regard of the sensor, and is bright enough to be seen by the sensor. Since the brightness usually doesn"t vary, and the line of sight between the object and the sensor can be predicted with great accuracy years in advance, the scheduling is pretty straightforward, other than the variable of weather. However, for satellites, the brightness is highly dependent on the orientation of the satellite and the solar phase anglethe angle between the sun-satellite-sensor. Furthermore, our knowledge of the orbit is not precise enough for us to predict months in advance what the optimal viewing opportunities will be. Current processes are manpower intensive and mostly based on whether the satellite breaks the horizon, and an average brightness that doesn"t account for phase angle. Collecting data under sub-optimal conditions can lead to data that is useless, thus wasting resources that could be devoted elsewhere. AFRL has previously developed detailed models that accurately predict the appearance of a satellite under a variety of illumination conditions. Furthermore, validated models of noise caused by atmospheric turbulence and scattering are prevalent within the academic community. AFRL is seeking an automated methodology to use an

understanding of satellite radiometry, site-specific parameters, satellite orbital uncertainties and atmospheric turbulence and scattering to improve our ability to plan observation schedules and improve efficiency. While model-based predictions are often a good predictor of brightness, sometimes models are wrong or are unavailable. The system can have access to a historical database of observations including object number, day/time, and calibrated magnitude, enabling the ability to choose optimum viewing conditions based on actual data, rather than based on models. Automated methods are preferred over manual methods. PHASE I: Develop a logic tree of factors for mission planning. Assess existing databases, radiometric, atmospheric, noise models and performance data against the logic tree. Formulate an automated method that provides a 6-month schedule, a refined monthly schedule and a detailed weekly schedule to optimize collection opportunities for a variety of sensor systems and runs within 2 minutes. PHASE II: Implement an improved mission planning tool that permits AFSPC and AFRL SSA assets to improve collection efficiency and success. Develop an automated method for mission planning that provides a 6-month schedule, a refined monthly schedule and a detailed weekly schedule to optimize collection opportunities. Demonstrate the mission planning tool using AFRL telescopes at the Maui Space Surveillance and Starfire Optical Range sites. PHASE III DUAL USE APPLICATIONS: Worldwide deployment to AFSPC and AFRL SSA assets.